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Assessing visual perception using letters and numbers

Janet Richmond
Edith Cowan University, j.richmond@ecu.edu.au

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Introduction

Letter and number literacy are important in education.

Difficulty with visual perception ⇒ difficulty with letters and numbers

Letters and numbers are presented in various contexts, size and font e.g.: hand-written, typed or diverse printed fonts.

Visual perception and fine motor skills develop in an integrated yet linear process

This linear development has a strong link to academic performance & enables children to integrate the skills equally well in tasks such as reading and writing

Recognition and written direction of letters and numbers typically develops along a similar linear process

Letter and number orientation affects legibility and understanding

Children who make reversal errors exhibit poor visual-motor skills and poor visual perceptual skills, resulting in a tendency to make less progress in reading, writing, mathematics and general academic performance

Children with reading difficulty make more errors in letter and number orientation

Aim:

To create a new visual perceptual test using letters and numbers in isolation and in context.

Producing a linear scale to measure the ability of primary school children to visually discriminate upper and lower case letters in readiness for learning to read and perform mathematical calculations.

Method

A Rasch measurement model analysis of recognised and hand written letter and number reversals

Ethical approval through Edith Cowan University,

Perth, Western Australia

Victorian Modern Cursive Font

324 pre-primary and primary up to Year 4 students

177 girls and 146 boys, Aged 4-9 years old.

Specialist focus group determined content validity

Pilot study with 20 children determined appropriate, user friendly design

Completed letter and number recognition scale encompassing visual discrimination, form constancy, figure ground, spatial orientation and sequencing of letters and numbers (Richmond Reversal Rating)

Wrote alphabet, numbers and twenty dictated words from memory

Data on all items were Rasch analyzed to create eight linear scales.

One, two buckle my shoe;

Three, four knock at the door

Results

Recognised/read reversals			
• P	c	a	4
• D	s	g	7
• K	t	q	9
• E	d	z	3

Written reversals			
• j	z	b	c
• i	q	t	d
• l	p	s	

Rasch Analysis produced eight highly reliable, linear, uni-dimensional scales;

Items ordered from easy to hard and student measures from low to high on the same scale.

The fit residual statistics for each scale and the targeting were reasonable.

Children inclined not to attempt letters that were confusing

Disproportionate letter reversals in j, z, b, c, q, i, t, d, l, p, s

Easiest letters and numbers - symmetrical around vertical axis (T, x, 8),

Moderately easy- straight, long downward stoke to left (B, h, k) and
- letters with only a body (o, r, u, c)

Most difficult - letters and numbers presented in incorrect orientation

Independently written letters reversed more often than those written within words

j, i, l, b reversed in writing but not in recognition task

g, a, K and E reversed in recognition task but not in writing.

References

ERHARDT, R. P. & DUCKMAN, R. H. 2005. Visual-perceptual-motor dysfunction and its effects on eye-hand coordination and skill development. *In:* GENTILE, M. (ed.) *Functional visual behaviour in children: An occupational therapy guide to evaluation and treatment options.* Bethesda, Maryland: AOTA Press.

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Discussion

Implications for occupational therapy: These scales are useful in identifying, accurately and objectively, students who require additional assistance in learning their letters and numbers ⇒ targeted intervention can begin prior to habits forming.

Integrated approach of letter sounds, formations and directionality matching used in memorising letters and numbers in the learning phase.

Written orientation of letters and numbers combined with the ability to recognise when an error has been made in the printed orientation of letters and numbers, require more targeted attention in teaching children to write, read and spell.

Most commonly reversed letters in the English language, b / d / p / q and t / c are easily confused due to similarity in shape and sound

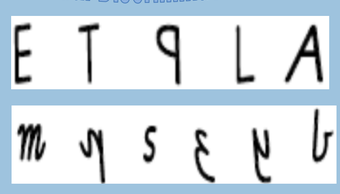
Number sequences are easier than letter sequences in learning and should be addressed first

Identification and targeted intervention will enable full inclusion and engagement into classroom activities

The occupation of reading and writing which are participated in during school hours will be accessible to all students

Item Examples

Visual Discrimination



Form Constancy

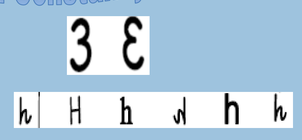
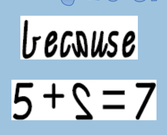
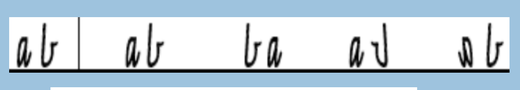


Figure Ground



Sequencing



soac/saoc, laugh/laugh

Implications

Intervention targeted to occupation

Improved visual perception

Improved academic achievement

Inclusion and engagement in class

Research:

Further development of miss-fit items

Expanded to qualitative input from students and teachers

Discriminant and known-group validity study

Contact details:

Email: j.richmond@ecu.edu.au

Phone: +61 44 833 7003